CLAIMS

1. Method for designing a nuclear fuel assembly (1) which is intended to be positioned in a nuclear reactor, the assembly comprising a plurality of guide tubes (24), and a control cluster (4) which itself comprises a plurality of control rods (10) and a support (11) for control rods (10), the control rods (10) and the guide tubes (24) extending in parallel with a longitudinal direction (L), each control rod (10) being received in a guide tube (24) in order to form pairs comprising guide tubes/control rods, each guide tube (24) comprising a lower damping portion (26) which comprises at least a portion of reduced inside diameter, which portion is intended to contain a fluid for damping the fall of the control rod (10) which is received in the guide tube (24), the portion of reduced inside diameter surrounding the control rod with a radial passage gap (J) when the control rod (10) is introduced in the guide tube (24), characterized in that the method comprises, for at least one pair comprising a guide tube/control rod, the following steps:

a) establishing the falling speed of the control rod (10) upon entry into the lower damping portion (26) when the control cluster (4) falls in the event of a shutdown of the nuclear reactor,

b) establishing, based on the falling speed established in step a), the progression of the falling speed of the control rod (10) in the lower damping portion,

c) establishing, based on the progression of the speed established in step b), a maximum elevated pressure

(ΔP_{MAX}) produced in the liquid contained in the lower damping portion (26), and

d) establishing, based on the maximum elevated pressure (ΔP_{MAX}) established in step c), a maximum circumferential stress ($\sigma_{\theta MAX}$) produced in the lower damping portion (26).

2. Method according to claim 1, characterized in that it further comprises a step for verifying, using the maximum circumferential stress ($\sigma_{\theta MAX}$) established in step d), that a maximum stress admissible by the guide tube (24) has not been exceeded.

3. Method according to claim 1 or 2, characterized in that the establishing step b) is carried out using a higher value for the radial passage gap (J) and the establishing step c) is carried out using a lower value for the radial passage gap (J).

4. Method according to claim 3, characterized in that the higher value is a maximum statistical value for the passage gap (J).

5. Method according to claim 3 or 4, characterized in that the lower value is a minimum statistical value for the passage gap (J).

6. Method according to any one of the preceding claims, characterized in that the support (11) of the control cluster (4) comprising a helical spring (16) for damping the impact of the support (11) against an upper end piece (7) of the assembly in the event of the control cluster (4) falling during a shutdown of the nuclear

reactor, the method further comprises the following steps:

e) establishing the progression of the speed of the control cluster (4) after the impact of the support (11) against the upper end piece (7),

f) establishing, based on the progression of the speed established in step e), a maximum longitudinal load (F_{MAX}) for compression of the spring (16), and

g) establishing, based on the maximum longitudinal load for compression (F_{MAX}), at least a maximum shearing stress (τ_{MAX}) in the spring (16).

7. Method according to claim 6, characterized in that a maximum shearing stress (τ_{MAX}) is a shearing stress along the neutral axis (FN) of the spring (16).

8. Method according to claim 6 or 7, characterized in that a maximum shearing stress is a shearing stress along the axis (F2) of the spring (16) nearest the longitudinal centre axis (A) thereof.

9. Method according to any one of claims 6 to 8, characterized in that it further comprises a step for verifying, using a maximum shearing stress established in step g), that a maximum stress admissible by the spring (16) has not been exceeded.

10. System for designing a nuclear fuel assembly, characterized in that it comprises means for carrying out the steps of a method according to any one of the preceding claims.

11. System according to claim 10, characterized in that it comprises a computer (34) and storage means (36), in which at least a programme comprising instructions for carrying out steps of the method for designing a nuclear fuel assembly is stored.

12. Computer programme comprising instructions for carrying out the steps of a method according to any one of claims 1 to 9.

13. Medium which can be used in a computer and on which a programme according to claim 12 is recorded.